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ABSTRACT

Preceded by three studies of preschool children, this research compared the thinking abilities of 5-year-old white and black children in relation to certain environmental factors. All of the 2413 children were chosen to conform with the earlier studies by having approximately one-fourth with mothers having graduated from college, one-half graduated from high school, and one-fourth with ninth grade education or less. A questionnaire covering the environmental influences in the life of the child was asked of each mother, and the questions were analyzed to determine the relationship to the thinking ability of the children. Some of the findings were: marital status is more related to performance in black children than in white; father's occupation has a more differentiating effect in blacks than in white in the semantic context; age is more effective for spatial abilities than for language; sex contributes little at this age level; race is more effective for language-based performance than for spatial relations; white children with higher scores seem to have more permissive, more concerned homes; black children with high performance seem to have highly structured homes with concerned, striving adults. (LH)

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FINAL REPORT

Project No. ~~9-70-0067~~

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Comparison of Thinking Abilities of Five-Year-Old White and Black Children in Relation to Certain Environmental Factors

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May 1972

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CONTENTS

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To those persons who so faithfully and efficiently did the testing and interviewed the parents in collecting the questionnaires, the investigator is extremely grateful. And to the more than 600 children, their parents and, in many instances, the teachers of Head Start and kindergartens, where the children were found, she also owes a debt of gratitude.

Rachel S. Ball, Investigator

SUMMARY

Three studies of preschool children have preceded this research, two of three and four-year-old children and one longitudinal study in which the three and four-year-olds were retested at five years.

The present research includes the 1947 retested five-year-olds and 255 other white five-year-olds. In addition, 211 black five-year-olds were tested, most of them by black examiners. All of the children were chosen to conform with the earlier studies by having approximately one-fourth with mothers having graduated from college, one-half with mothers who were high school graduates, and one-fourth with ninth grade education or less.

A questionnaire covering the environmental influences in the life of the five-year-olds was asked of each mother. These questions were analyzed to see what relationships could be found to the thinking ability of these children.

The test instrument used for evaluating the thinking aptitudes of the five-year-old children was similar in content to that used in the earlier studies, but was increased in difficulty in nine of the 18 tests. Hence, they were not comparable so that a reliability study could not be developed although factor patterns could be compared at the three age levels.

It proved to be more difficult to find white children with mothers having no more than ninth grade education, and it was equally difficult to find black mothers who were graduated from college.

Scoring of the protocols was done by the investigator. The scores were tabulated for computer treatment. The programming and computer work was done by Philip R. Merrifield, who had been also responsible for the computer work done in the earlier studies.

The two groups of children, the white and the black, were first studied separately. Correlations and factor analyses were made for each. The factors for each were identified and then compared.

Finally, the two groups were combined, the black children's performances were recoded to the white children's intervals to be used in deriving the factor scores for the combined sample for comparison with the questionnaire data.

<u>Findings</u>. For both white and black children, the separate factor analyses were labeled and compared. The factors for each group were consistently similar with the same major loadings for each factor. When the results of comparing performances of white

and black children are evaluated, four of the tasks were performed better by the blacks than by the whites, and 14 better by the whites. However, while statistically significant differences occur in level of performance on these tasks, the utility of race as a predictor of performances is very low, probably no more than that of sex and less than that of age. In every task, the range of performances for the two groups was equal or nearly so. There was a greater systematic differentiation of children in the black group; they are more heterogeneous with respect to the factors being measured than are the white children. The white group showed more semantic emphasis in their high scores.

When the two groups were combined, the factor analyses yielded two clear factors and two less distinct--Factor 1 is divergent semantic thinking and Factor 2 is convergent figural. Factor 3 is cognitive reasoning and Factor 5 carries a sense of psychomotor involvement.

The method used for the study of predictive value for the questionnaire items as evaluated with the aptitudes is the stepwise multiple-correlation technique. Three groups were studied--a combined sample, a white sample and a black sample. By this process, some of the most significant findings were:

- Fifteen percent of the variance in Factor A can be attributed to race, much less with Factor B and reversed with Factor E, so that, in the figural cognitive aptitudes, black children outperform white children.
- The figural Factors B and E are positively related to age.
- Boys had higher means than girls in Factor A while sex seems unrelated to B and E.
- Education of the mother is a contributor to all three factors except for Factor E in black children.
- Marital status is more related to performance in black children than in white.
- White children in Phoenix had higher scores in all three factors.
- Whether the parents play with the child is clearly a source contributing to performance on Factor A.
- The father's occupation has a more differentiating effect in blacks than in whites in the semantic content.
- Whether the parents had anxiety about traits shown by the child contributed positively to the white child's performance on A, but negatively to the black child's performance on E.

- Going to the movies seems to have no effect on white children but a deleterious effect on black children.
- Age is more effective for spatial abilities than for language.
- Sex contributes little at this age level.
- Race is more effective for language based performance than for spatial relations.
- Marital status contributes more in blacks than in whites.
- Area differences are marked for the white children.
- White children with higher scores seem to have more permissive, more concerned homes.
- Black high performing children seem to have highly structured homes with concerned striving adults.

INTRODUCTION

Purposes and Objectives

Overall programs. Three studies of preschool children have preceded this study of white and black five-year-old children. These earlier studies were of three and four-year-old white children from English speaking homes. The reports of these three research studies have been made in detail. It seemed desirable to discover the developmental changes which have taken place with five-year-old children in their ability to do the Test of Thinking. Both black and white five-year-olds were studied and these responses were related to the environmental information which was obtained by interviewing the parents. A questionnaire covering various aspects of the child's home environment was asked of each mother.

The test intrument for evaluating the thinking abilities of the five-year-old children was similar to that used for three and four-year-olds, but was increased in difficulty for nine of the tests. Factor analysis of these test results were made to discover the factor patterns for five-year-olds, and to compare them with the results for the younger ages.

Another objective was to present a series of test items for preschool children which would utilize modern techniques for analyzing the data. In recent years, with the development of more insightful techniques with the blessing of computer facilities for statistical analyses, much has been learned about the nature of the human intellect, although the studies heretofore made did not extend to the younger preschool ages. The Guilford model of Structure of Intellect was used. In the three previous studies involving the preschool children with the Test of Thinking, differentiation was made of three kinds of process, contrasting cognition, convergent productive thinking and divergent productive thinking. These three processes do not cover the range of abilities explored by Guilford and others, but do relate to three important aspects of thinking. In addition, motor control was found to be inextricably involved in many of the responses.

There was a need to determine more adequately whether and to what degree the intellectual abilities are differentiated in children of preschool age. What environmental factors influence the differential development of childhood? A major purpose of these studies, therefore, was to investigate the "structural" nature of preschool mentality. The previous studies have shown that each preschool child has his own pattern of development and that the structure of intellect varies from child to child. The strengths and weaknesses of his mental development yield individual patterns which are important to discover and utilize in evaluating his growth and developmental needs. Do the black children differ in any way in their developmental patterns from the white children? If there are differences, can they be related to differences in environment?

A final objective as the results of these separately developed series of research studies is to develop a standardized test for the measurement of the specific mental functions and abilities which characterize the different preschool age levels.

Analysis of the Present Project

Since the findings of the previous studies show a differentiation in the modes of thinking of three and four-year-old white children, can we determine that the same differentiation is true of five-year-olds? Since we were able to obtain protocols on black five-year-old children as well as on white five-year-olds, can we discover any qualitative effect, irrespective of quantitative differences which may be present?

The black children were somewhat more difficult to obtain in our two areas of study, and the parents of these black children were more of a problem to interview because it was difficult to find them at home.

While many of the white children had mothers who were not working and were accessible for interview, the black parents were away from home working more frequently and, while both black and white parents were cooperative, the blacks were not so easily reached. We had no parents of five-year-old children who refused the interview with the examiners. However, to facilitate the interviews and to make the tests with the black children more valid, much of the testing of the blacks was done by black examiners. Likewise, all the whites were examined by white persons. In the Detroit area, a white examiner was used with the black children. This may be a cause for some differentiation.

Since three educational levels were adhered to, for both blacks and whites, the educational backgrounds were comparable, as far as possible. However, we found it difficult to get white children whose mothers had no more than nine years or less in schooling, while it was equally difficult to find black mothers who had a college degree. However, we have tried to weight these differences in our comparative study of the two races.

General Procedures

Since many of the test items for the three and four-year-old children were too easy for five-year-olds, various devices were used to make them slightly more difficult.

Nine of the 18 tests were changed. Some of the tests given are sufficiently changed to cause possible difference in factor meaning. The tests had interest for the children; there were no refusals at year five. The usual time taken by the test was not more than one hour, often much less. A list of the tests used is given in Table I.

For administration, the tests were assembled in a sequence which was judged to be favorable for maintaining the child's interest. All tests were administered to one child at a time. A test record booklet was provided with adequate space for recording the child's verbal responses and his performance on manipulative items, as well as significant behavior during the examination. There were only three timed test items.

Selection and Training of Project Personnel

All but one of the examiners chosen had at least a master's degree is psychology. It was possible to find persons with experience with young children and ability to gain rapport with them. All of the examiners had been trained in giving mental tests and were trained to give the Test of Thinking.

Selection of Subjects

Two groups of children were used in this study of five-year-old children, 402 white and 211 black. Approximately one-third of each race were obtained from Detroit, Michigan, and vicinity and two-thirds from Phoenix and its suburbs. No attempt was planned to control for or to study the effects of social class per se, but, since the preschool child is usually in close association with his mother, his cognitive development is largely shaped by the quality of stimulation his mother provides.

Since it seemed possible that some part of this stimulation might depend upon the level of his mother's education, it was decided to include the mother's educational level as a selective criterion. Three levels of education were arbitrarily chosen--ninth grade or less, high school graduation and college graduation.

Procedures for Scoring the Test Items

Twenty-six measures were obtained from the 18 tests in the aptitude domain (Table 1.0) by individual administration. The administrators were trained by the investigator, who also either scored or closely supervised the scoring of the tasks. Details of these tasks are to be found in the appendix of this report. After each task was scored, frequency distributions were made and the children's performances were coded to an adaptation of the stanine scale. So far as possible, performances were scored to reflect a five category normal distribution with mean 5, standard deviation 1. The means and standard deviations presented in their appropriate tables indicate that

TABLE 1.0

Listing of Tests of Thinking Test Battery

White Children

N = 400

Test No.	Name	Means	S.D.'s
1	Little Pink Tower (time score, reversed)	3.232	1.150
2	Three Cube Pyramid (deleted in combined analysis)	3.050	1.078
3	Six Cube Pyramid	2.927	1.092
4	Ambiguous Forms (ideas)	3.095	.995
5	Ambiguous Forms (elaborations)	3.235	1.029
6	Hidden Figures	3.280	1.260
7	Geometric Abstractions	4.172	1.436
8	Word Meaning	3.050	1.028
9	Round Things	2.955	.953
10	Stick Test (matching)	3.615	.853
11	Stick Test (production)	3.472	.948
12	Stick Test (elaboration)	3.072	.937
13	Copy Star, Diamond	1.227	.846
14	Action Agent (deleted in combined analysis)	3.050	1.006
15	Agent Action	2.990	.964
16	Food Naming	2.982	1.016
17	Drawing Completion	3.337	.710
18	Pie Completion	2.920	1.007
19	Dot Test (originality)	3.015	1.058
20	Dot Test (following directions)	3.125	.790
21	Directions Test (boxes and cars)	3.217	1.259
22	Block Sorting (shape)	.955	.207
23	Block Sorting (color)	.810	.392
24	Block Sorting (size)	.612	.487
25	Thumb and Finger	.805	.455
26	Candy Bar (size) (deleted in combined analysis)	2.617	1.066

this aim was achieved for most of the variables, although marked skewing or dichotomous responses precluded normal coding in some cases. This coding was considered useful as the correlation coefficient of choice was the Pearson-r, and its assumptions should be honored whenever possible. Following the coding, data were entered on cards and the intercorrelation matrices for the two racial groups were computed separately.

Section 1--White Children Separately

The white children sample initially numbered 402. Due to missing data, two children were deleted. Of the 400 cases analyzed, 203 are boys and 197 are girls; 72 children had mothers who had finished only the ninth grade, 229 had mothers who had finished high school, and 99 had mothers who had attended college.

As stated before, the intercorrelation matrix shown in Table 1.1 was computed. Most of the r's are positive. The largest is .477, but sufficient numbers of low values occur to support the idea that several separate factors may be needed to explain the covariances of the matrix. As common factors are the objective, communality estimates were made for each variable. Following Guttman's recommendation, the communality estimates initially were squared multiple correlations, each variable being predicted from all others. These values of h^2 are incorporated as the last line of Table 1.2. The sum of these estimates will serve as a guide to the number of factors to be accepted as necessary to reproduce the correlation matrix.

The principal factors for these data are shown in Table 1.2 together with eigenvalues. As a stopping rule for the number of factors, a factor was included so long as the sum of the eigenvalues of previous included factors did not exceed the sum of the initial communality estimates. For these data, that situation would exclude the fifth factor. Sum $h^2 = 6.95$ while sum $1 = 7.217$ for the first four factors. However, because the fifth principal factor seemed to include some potentially differentiating loadings (e. g., #8, Semantic, vs. #13, Figural) and studies for younger ages with similar measures had indicated five factors, the fifth was included in the rotation to varimax criterion reported in Table 1.3. It will be noted that Factor 3 is heavily weighted with a single task, Block Sorting (#22, #23, #24), partly as a result of including five factors in the rotation.

In this analysis, following convention, a significant loading is considered to be one which exceeds .30 in magnitude. In the following discussion, measures are listed in order of magnitude greater than .30 with the addition of small magnitudes if the highest loading of a task does not exceed .30 but does fall on the factor being discussed. Tasks are considered to fall in the hyperplane of a factor if their magnitude does not exceed .10. All rotations are orthogonal.

In brief preview, the rotated factors in Table 1.3 may be labeled as follows:

TABLE 1.1

Intercorrelation Matrix, Aptitudes

White Five-Year-Olds

Test No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
1	1.000	.188	.201	-.006	-.055	.034	.115	.001	.010	.017	-.016	-.009	.128	-.004	.043	.140	-.047	.055	.032	.015	.096	.054	.026	.027	.053	.040
2	.188	1.000	.319	-.018	-.087	.074	.093	.041	.068	.064	.033	.034	.053	.113	.017	.060	.020	.077	.015	.069	.082	-.001	.017	.108	-.097	.075
3	.201	.319	1.000	.142	.091	.277	.257	.108	.220	.179	-.015	.188	.329	.128	.149	.123	.051	.338	.137	.254	.226	.107	.120	.248	.067	.131
4	-.006	-.018	.142	1.000	.408	.286	.060	.244	.305	.002	.098	.282	.200	.365	.316	.172	.096	.080	.098	.176	.053	.154	-.069	.045	.162	-.095
5	-.055	-.087	.091	.408	1.000	.302	.123	.310	.388	.049	.206	.384	.125	.401	.456	.090	.086	.064	.167	.222	.107	.167	-.075	.077	.178	-.107
6	.034	.074	.277	.286	.302	1.000	.264	.198	.331	.177	-.031	.275	.273	.293	.321	.162	.140	.264	.151	.229	.260	.058	-.085	.124	.165	.089
7	.115	.093	.257	.060	.123	.264	1.000	.140	.243	.103	-.142	.080	.190	.044	.169	.143	.196	.182	.066	.298	.250	.001	-.022	.071	.097	.182
8	.001	.041	.108	.244	.310	.198	.140	1.000	.388	.147	.035	.188	.194	.365	.477	.266	.186	.173	.151	.162	.250	.034	-.026	.019	.106	.070
9	.010	.068	.220	.305	.388	.331	.243	.388	1.000	.173	.026	.334	.298	.412	.448	.203	.266	.278	.219	.266	.317	.040	-.083	.011	.078	.020
10	.017	.064	.179	.002	.049	.177	.103	.147	.173	1.000	-.004	.013	.350	.087	.123	.165	.037	.255	.070	.142	.262	.114	.133	.092	.058	.086
11	-.016	.033	-.015	.098	.206	-.031	-.142	.035	.026	-.004	1.000	.246	-.009	.347	.131	-.023	-.044	-.094	.135	-.085	-.109	.197	-.034	.055	.098	-.111
12	-.009	.034	.188	.282	.384	.275	.050	.188	.334	.013	.246	1.000	.077	.317	.355	.101	.151	.149	.125	.174	.180	.030	-.099	-.010	-.014	-.075
13	.128	.053	.329	.200	.125	.273	.190	.194	.298	.350	-.009	.077	1.000	.192	.199	.147	.155	.385	.167	.339	.268	.058	-.005	.087	.219	.105
14	-.004	.113	.128	.365	.401	.293	.044	.365	.412	.087	.347	.317	.192	1.000	.467	.243	.102	.154	.253	.121	.181	.191	-.052	.131	.169	-.012
15	.043	.017	.149	.316	.456	.321	.169	.477	.448	.123	.131	.355	.199	.467	1.000	.275	.202	.146	.145	.235	.189	.073	-.117	.098	.144	-.057
16	.140	.060	.123	.172	.090	.162	.143	.266	.203	.165	-.023	.101	.147	.243	.275	1.000	.182	.162	.023	.137	.257	.008	.017	.047	.063	.121
17	-.047	.020	.051	.096	.086	.140	.196	.186	.266	.037	-.044	.151	.155	.102	.202	.182	1.000	.129	-.003	.183	.161	.001	.033	-.005	.057	-.024
18	.055	.077	.338	.080	.064	.264	.182	.173	.278	.255	-.094	.149	.385	.154	.146	.162	.129	1.000	.076	.236	.296	.031	-.083	.004	.102	.146
19	.032	.015	.137	.098	.167	.151	.066	.151	.219	.070	.135	.125	.167	.253	.145	.023	-.003	.076	1.000	.129	.114	-.008	.001	.021	.074	.023
20	.015	.069	.254	.176	.222	.229	.298	.162	.266	.142	-.085	.174	.339	.121	.235	.137	.183	.236	.129	1.000	.226	.019	.044	.074	.144	.072
21	.096	.082	.226	.053	.107	.260	.250	.250	.317	.262	-.109	.180	.268	.181	.189	.257	.161	.296	.114	.226	1.000	.057	.089	.150	.017	.245
22	.054	-.001	.107	.154	.167	.058	.001	.034	.040	.114	.197	.030	.058	.191	.073	.008	.001	.031	-.008	.019	.057	1.000	.202	.223	.172	.001
23	.026	.017	.120	-.069	-.075	-.085	-.022	-.026	-.083	.133	-.034	-.099	-.005	-.052	-.117	.017	.033	-.083	.001	.044	.089	.202	1.000	.295	.087	.131
24	.027	.108	.248	.045	.077	.124	.071	.019	.011	.092	.055	-.010	.087	.131	.098	.047	-.005	.044	.021	.074	.150	.223	.295	1.000	.167	.100
25	.053	-.097	.067	.162	.178	.165	.097	.106	.078	.058	.098	-.014	.219	.169	.144	.063	.057	.102	.074	.144	.017	.172	.087	.167	1.000	-.009
26	.040	.075	.131	.095	-.107	.089	.182	.070	.020	.086	-.111	-.075	.105	-.012	-.057	.121	-.024	.146	.023	.072	.245	.001	.131	.100	-.009	1.000
h^2	.118	.179	.358	.295	.408	.303	.228	.325	.419	.219	.271	.321	.362	.459	.454	.201	.158	.292	.124	.248	.301	.171	.210	.208	.164	.149

Average R = .126
Average R (Absolute Values) = .139

TABLE 1.2

Principal Axis Analysis

White Five-Year-Olds

Variable	Factor 1	2	3	4	5
1	.096	-.197	.088	-.208	.036
2	.131	-.213	.099	-.393	.110
3	.432	-.359	.181	-.288	-.124
4	.457	.282	.042	.039	-.135
5	.533	.403	.045	.090	-.113
6	.542	-.056	-.049	-.025	-.139
7	.354	-.282	-.142	.025	-.150
8	.520	.110	-.118	.111	.254
9	.652	.076	-.188	-.004	.040
10	.302	-.276	.088	.103	.025
11	.119	.398	.321	-.176	.018
12	.453	.276	-.070	-.206	-.038
13	.498	-.288	.011	.063	-.227
14	.591	.334	.174	-.095	.151
15	.634	.269	-.082	.039	.136
16	.365	-.097	-.072	.050	.272
17	.289	-.039	-.179	.137	.070
18	.424	-.311	-.112	-.049	-.125
19	.278	.061	.045	-.084	-.047
20	.439	-.186	-.082	.090	-.182
21	.452	-.319	-.059	.048	.194
22	.170	.052	.434	.105	-.010
23	-.023	-.232	.397	.192	.137
24	.186	-.163	.439	.066	.053
25	.246	.023	.230	.241	-.179
26	.095	-.359	.024	.029	.164
λ	4.134	1.594	.934	.555	.492

TABLE 1.3

Varimax Rotated Factor Loadings

White Five-Year-Olds

Variable	Factor 1	2	3	4	5
1	-.022	.087	.050	.299	.023
2	.024	.040	.004	.484	.046
3	.137	.419	.168	.473	.010
4	.515	.174	.068	-.097	.021
5	.638	.148	.084	-.174	.061
6	.346	.421	.027	.085	.122
7	.035	.420	-.025	.103	.198
8	.377	.143	.013	-.038	.457
9	.480	.348	-.083	.033	.330
10	.003	.309	.207	.097	.196
11	.420	-.264	.182	.084	-.146
12	.539	.104	-.117	.105	.063
13	.152	.573	.137	.096	.082
14	.658	.015	.169	.103	.226
15	.593	.164	.003	-.041	.349
16	.144	.139	.042	.089	.418
17	.121	.212	-.057	-.085	.266
18	.088	.496	-.016	.180	.142
19	.258	.124	.038	.089	.027
20	.163	.485	.041	.009	.109
21	.060	.350	.095	.182	.426
22	.173	-.005	.447	.016	-.038
23	-.188	-.013	.471	.051	.089
24	.039	.081	.477	.153	.046
25	.172	.216	.317	-.158	-.047
26	-.199	.164	.113	.175	.238

Factor 1: Divergent thinking, semantic
Factor 2: Convergent productive thinking, figural
Factor 3: Block sorting, specific cognitive reasoning
Factor 4: Convergent thinking (patterns), figural
Factor 5: Convergent thinking, semantic

The factors for five-year-old white children:

Factor 1: Divergent Thinking, Semantic

Factor Loading	Task No.	Task Name
.658	14	Actian Agent
.638	5	Ambiguous Forms (elaborations)
.593	15	Agent Action (5)
.539	12	Stick Test (elaboration)
.515	4	Ambiguaus Forms (ideas)
.480	9	Round Things (2, 5)
.420	11	Stick Test (production)
.377	8	Ward Meanings (5)
.346	6	Hidden Figures (2)

Hyperplane: 1, 2, 7, 10, 18, 21, 24

All tasks with significant loadings involve productive thinking under relatively loose boundaries, although a case could be made for Action Agent and Agent Action being somewhat convergent in tone. Stick Test (elaboration) requires the child to label his responses semantically and he may well think of a form by name (semantic) prior to producing it in Task #11. Similarly, Hidden Figures and Dot Test may involve some private verbalizations as facilitators. The hyperplane includes at least one representative of each other factor in this solution.

Factor 2: Convergent Thinking, Figural

Factor Loading	Task No.	Task Name
.573	13	Copy Star, Diamond
.496	18	Pie Completion
.485	20	Dot Test (following directions)
.421	6	Hidden Figures (1)
.420	7	Geometric Abstractions
.419	3	Six Cube Pyramid (3)
.350	21	Directions Test (boxes and cars) (5)
.348	9	Round Things (1, 5)
.309	10	Stick Test (matching)

Hyperplane: 1, 2, 14, 22, 23, 24

Clearly figural in mode, a choice between convergent and divergent thinking is necessary in labeling this factor. On balance, it seems more convergently productive thinking. The hyperplane includes representatives of Factors 1, 3 and 4 but not Factor 5.

Factor 3: Block Sorting, Cognitive Reasoning

Factor Loading	Task No.	Task Name
.477	24	Block Sorting (size)
.471	23	Block Sorting (color)
.447	22	Block Sorting (shape)
.317	25	Thumb and Finger Opposition

Hyperplane: 1, 2, 4, 5, 6, 7, 8, 9, 15-21

If one rationalizes that Task #25 involves sequential but separate classification, then its appearance with the Block Sorting tasks may be accepted. Otherwise, one must suggest that Block Sorting requires some psychomotor skill, since Thumb and Finger Opposition is usually found with that factor meaning. The broad hyperplane supports labeling this factor as a specific, but, since the two latter factor analyses tend to show cognitive significance, it is so labeled here.

Factor 4: Block Building, Convergent Thinking, Figural Systems

Factor Loading	Task No.	Task Name
.484	2	Three Cube Pyramid
.473	3	Six Cube Pyramid (2)
.299	1	Little Pink Tower

Hyperplane: 4, 6-17, 19, 20, 22, 23

These tasks all involve building with blocks following a pattern presented initially by the observer. In previous analyses with younger children, this grouping of tasks was considered to represent thinking about patterns. In this group, many children seem to do it very quickly, but there is a substantial number who takes a long time to "see the problem." The broad hyperplane reinforces the labeling as a specific.

Factor 5: Convergent Thinking, Semantic

Factor Loading	Task No.	Task Name
.457	8	Word Meanings (1)
.426	21	Directions (boxes and cars) (2)
.418	16	Food Naming
.349	15	Agent Action (1)
.330	9	Round Things (1, 2)
.266	17	Drawing Completion
.238	26	Candy Bar (size)

Hyperplane: 1-5, 12, 13, 19, 22-25

Although these tasks require productive thinking and multiple responses, the tasks themselves are quite goal oriented. The hyperplane includes representatives of each other factor in this solution.

Summary of Section 1:

The five factor solution adopted here is not entirely satisfactory. However, the four factor rotation shows Factor 5 merging with Factor 2, leaving the two specifics labeled here relatively intact. In a three factor solution, Factors 4 and 5 merge with Factor 2. Thus what is clearly demonstrated is a differentiation between divergent thinking in semantic mode and convergent thinking in both semantic and figural mode. The other two combinations, particularly divergent thinking in figural mode, did not emerge clearly in this analysis.

Section 2--Black Children Separately

Initially 211 black children were tested. Minor attrition reduced that number to 209 cases in this analysis. Of those, 100 were boys and 109 girls; 60 had mothers who graduated only from ninth grade, 106 had mothers who were high school graduates, and 63 had mothers who attended college.

Procedures for administration of the tasks, scoring, coding, intercorrelation and factor analysis were the same as for the white children and analyzed separately. Means and standard deviations for the same 26 variables are shown in Table 2.0. Intercorrelations and principal factors are in Tables 2.1 and 2.2, respectively. Factors rotated to the varimax criterion are displayed in Table 2.3, with discussion of the factors following in the same format as before.

TABLE 2.0

Listing of Test of Thinking Test Battery

Black Children

N = 209

Test No.	Name	Means	S.D.'s
1	Little Pink Tower (time score, reversed)	3.053	1.125
2	Three Cube Pyramid (deleted in combined analysis)	3.048	1.030
3	Six Cube Pyramid	2.909	1.263
4	Ambiguous Forms (ideas)	2.871	.895
5	Ambiguous Forms (elaborations)	2.962	1.115
6	Hidden Figures	2.981	1.044
7	Geometric Abstractions	3.139	.915
8	Word Meanings	2.789	1.037
9	Round Things	3.029	1.169
10	Stick Test (matching)	2.837	.369
11	Stick Test (production)	3.134	.813
12	Stick Test (elaboration)	2.536	.953
13	Copy Star, Diamond	1.526	.527
14	Action Agent (deleted in combined analysis)	3.144	.997
15	Agent Action	3.196	.981
16	Food Naming	2.890	.999
17	Drawing Completion	3.019	.800
18	Pie Completion	2.967	1.064
19	Dot Test (originality)	2.627	1.729
20	Dot Test (following directions)	2.880	1.166
21	Directions Test (boxes and cars)	3.019	.788
22	Block Sorting (shape)	.871	.335
23	Block Sorting (color)	.766	.424
24	Block Sorting (size)	.598	.519
25	Thumb and Finger	.837	.369
26	Candy Bar (size) (deleted in combined analysis)	2.785	1.197

TABLE 2.1

Intercc·:alation Matrix, Aptitudes

Black Five-Year-Olds

Test No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
1	1.000	.114	.428	.083	-.010	.046	.030	.124	.035	.147	-.065	.000	.082	-.122	-.183	-.093	.073	.169	.091	.231	.344	.132	.116	.126	.343	.207
2	.114	1.000	.081	-.040	-.178	.108	-.307	.063	.023	-.105	.409	.062	.139	.194	.081	.275	.016	.036	.131	.005	-.119	.295	.212	.099	-.156	-.108
3	.428	.081	1.000	.201	.147	-.085	.048	.175	.190	.297	-.277	.029	.208	-.153	.084	-.209	.148	.204	.059	.321	.405	.029	.076	.207	.420	.212
4	.083	-.040	.201	1.000	.254	.013	.028	.249	.269	.168	.042	.087	.002	.058	.280	.118	.104	-.025	-.016	.077	.092	-.040	-.017	-.040	.067	.081
5	-.010	-.178	.147	.254	1.000	.213	.404	.275	.221	.113	-.121	.204	.116	.332	.414	-.051	.146	.043	.050	.081	.246	.012	.082	.205	.217	.087
6	.046	.108	-.085	.013	.213	1.000	.373	.226	.345	.153	.155	.121	.236	.407	.279	.186	.172	.236	.150	.234	.175	.198	.303	.242	.166	.131
7	.030	-.307	.048	.028	.404	.373	1.000	.177	.202	.138	-.173	.249	.126	.288	.215	-.140	.212	.191	-.016	.182	.328	.027	.207	.208	.166	.154
8	.124	.063	.175	.249	.275	.226	.177	1.000	.301	.086	-.040	.230	.141	.279	.224	.065	.218	.007	.052	.145	.315	.101	.171	.207	.136	.029
9	.035	.023	.190	.269	.221	.345	.202	.301	1.000	.221	.041	.158	.208	.329	.296	.228	.275	.308	.055	.203	.238	.168	.245	.153	.221	.110
10	.147	-.105	.297	.168	.113	.153	.138	.086	.221	1.000	-.007	.044	.145	.168	.062	-.010	.092	.254	.130	.244	.307	-.015	.001	.108	.333	.300
11	-.065	.409	-.277	-.042	-.121	.155	.173	-.040	.041	-.007	1.000	.056	-.031	.283	.069	.295	-.077	-.006	.070	-.084	-.205	.186	.091	-.199	-.151	-.034
12	.000	.062	.029	.087	.204	.121	.249	.230	.158	.044	.056	1.000	.086	.221	.154	.057	.062	-.006	-.006	-.024	.088	-.023	.050	.068	.098	.021
13	.082	.139	.208	.002	.116	.236	.126	.141	.208	.145	-.031	.086	1.000	.148	.106	.155	.158	.381	.137	.250	.229	.195	.231	.388	.071	.104
14	-.122	.194	-.153	.058	.332	.407	.288	.279	.329	.168	.283	.221	.148	1.000	.519	.333	.170	.077	.053	.093	.039	.213	.204	.158	-.002	.042
15	-.183	.081	.084	.280	.414	.279	.215	.224	.296	.062	.069	.154	.106	.519	1.000	.345	.135	-.007	-.132	.046	.107	.135	.145	.155	.049	-.062
16	-.093	.275	-.209	.118	-.051	.186	-.140	.065	.228	-.010	.295	.057	.155	.333	.345	1.000	.074	-.017	-.049	-.024	-.113	.215	.154	.118	-.152	-.136
17	.073	.016	.148	.104	.146	.172	.212	.218	.275	.092	-.077	.062	.158	.170	.135	.074	1.000	.242	.060	.249	.234	.241	.295	.191	.156	.149
18	.169	.036	.204	-.025	.043	.236	.191	.007	.308	.254	-.006	-.006	.381	.077	-.007	-.017	.242	1.000	.240	.425	.326	.176	.152	.175	.266	.291
19	.091	.131	.059	-.016	.050	.150	-.016	.052	.055	.130	.070	-.006	.137	.053	-.132	-.049	.060	.240	1.000	.182	.058	-.025	.116	.137	.122	.114
20	.231	.005	.321	.077	.081	.234	.182	.145	.203	.244	-.084	-.024	.250	.093	.046	-.024	.249	.425	.182	1.000	.383	.181	.282	.356	.311	.393
21	.344	-.119	.405	.092	.246	.175	.328	.315	.238	.307	-.205	.088	.229	.039	.107	-.113	.234	.326	.058	.383	1.000	.299	.343	.417	.422	.324
22	.132	.295	.029	-.040	.012	.198	.027	.101	.168	-.015	.186	-.023	.195	.213	.135	.215	.241	.176	-.025	.181	.299	1.000	.696	.444	.023	.110
23	.116	.212	.076	-.017	.082	.303	.207	.171	.245	.001	.091	.050	.231	.204	.145	.154	.295	.152	.116	.282	.343	.696	1.000	.573	.031	.099
24	.126	.099	.207	-.040	.205	.242	.208	.207	.153	.108	-.099	.068	.389	.158	.155	.118	.191	.175	.137	.356	.417	.444	.573	1.000	.183	.084
25	.343	-.156	.420	.067	.217	.166	.166	.136	.221	.333	-.151	.098	.071	-.002	.049	-.152	.156	.266	.122	.311	.422	.023	.031	.183	1.000	.278
26	.207	-.108	.212	.081	.087	.131	.154	.029	.110	.300	-.034	.021	.104	.042	-.062	-.136	.149	.291	.114	.393	.324	.110	.099	.084	.278	1.000
h^2	.349	.465	.551	.271	.400	.408	.474	.307	.385	.303	.354	.164	.313	.546	.515	.381	.208	.420	.195	.398	.519	.586	.636	.506	.398	.281

Average R = .137
Average R (Absolute Value) = .164

TABLE 2.2

Principal Axis Analysis

Black Five-Year-Olds

Variable	Factor 1	2	3	4	5
1	-.291	-.348	.239	-.174	-.171
2	-.069	.414	.420	-.335	-.162
3	-.416	-.480	.056	-.226	-.375
4	-.203	-.005	-.290	-.234	-.292
5	-.409	.028	-.479	.124	-.086
6	-.493	.280	-.090	-.010	.295
7	-.449	-.057	-.380	.344	.230
8	-.415	.091	-.205	-.038	-.261
9	-.519	.151	-.176	-.194	.002
10	-.372	-.224	-.105	-.272	.129
11	.048	.480	.186	-.294	.149
12	-.201	.122	-.236	-.019	-.036
13	-.435	.053	.152	-.043	.080
14	-.411	.550	-.278	-.102	.148
15	.363	.425	-.411	-.050	-.205
16	-.117	.559	.049	-.205	-.071
17	-.419	.025	.009	.051	-.005
18	-.475	-.175	.179	-.168	.351
19	-.184	-.065	.157	-.160	.221
20	-.547	-.224	.174	-.073	.146
21	.647	-.319	.045	.133	-.107
22	-.450	.324	.471	.224	-.141
23	-.562	.282	.400	.347	-.097
24	-.577	.073	.254	.298	-.108
25	-.444	-.408	-.079	-.143	.003
26	-.357	-.295	.057	-.106	.207
λ	4.373	2.360	1.693	1.009	.885

TABLE 2.3

Varimax Rotated Factor Loadings

Black Five-Year-Olds

Variable	Factor 1	2	3	4	5
1	.272	-.006	-.104	.139	.467
2	.000	.667	-.033	.198	.077
3	.245	-.120	.079	.090	.714
4	-.028	.041	.388	-.116	.314
5	.043	-.283	.574	.073	.052
6	.368	.078	.396	.239	-.247
7	.228	-.473	.416	.194	-.188
8	.041	-.007	.449	.170	.211
9	.292	.108	.488	.128	.095
10	.450	-.052	.195	-.075	.202
11	.057	.555	.042	-.008	-.252
12	.021	-.021	.333	.016	-.008
13	.323	.087	.140	.299	.052
14	.146	.248	.628	.135	-.293
15	-.108	.122	.698	.102	-.016
16	-.071	.503	.287	.124	-.140
17	.209	-.040	.226	.277	.077
18	.642	.002	.020	.161	.035
19	.352	.091	-.057	.040	-.006
20	.531	-.073	.067	.279	.192
21	.358	-.297	.194	.407	.363
22	.055	.249	.037	.730	.011
23	.101	.102	.112	.808	-.022
24	.165	-.060	.147	.664	.103
25	.425	-.230	.149	.031	.366
26	.478	-.142	.012	.063	.140

While means and standard deviations are not meaningfully comparable, both white and black children being normed to their own cumulative frequency distributions, it is instructive to compare the communalities for the two samples. The sum $h^2 = 10.14$ is half again as much as for the white children ($h^2 = 7.22$). A greater value for communality might imply fewer broader factors; certainly it implies greater systematic differentiation of children in the group from each other--they are more heterogeneous with respect to the factors being measured--and, in the present case, the patterning of the low magnitude r's suggests that several strong factors will emerge as the m structure of the correlation matrix.

The stopping rule previously used indicates that five factors should be studied in this analysis. Inspection of the fifth principal factor in Table 2.2 supports this decision. Thus, five factors were rotated orthogonally to the varimax criterion, with the result shown in Table 2.3, for which the same general expectation was held for factors of convergent and divergent thinking in semantic and figural modes.

The factors for five-year old black children:

Factor 1: Convergent Figural Thinking (NFU)

Factor Loading	Task No.	Task Name
.642	18	Pie Completion
.531	20	Dot Test (following directions)
.478	26	Candy Bar (size)
.450	10	Stick Test (matching)
.425	25	Thumb and Finger (5)
.368	6	Hidden Figures (3)
.358	21	Directions Test (boxes and cars) (4, 5)
.352	19	Dot Test (originality)
.323	13	Copy Star, Diamond

Hyperplane: 2, 4, 5, 8, 11, 12, 16, 22

This grouping of tasks is much clearer than in the white sample and is appropriately labeled convergent figural thinking. The hyperplane includes at least one representative of each other factor in this solution. It should be noted that the sequence of factors in a rotated solution is not a consistent guide to their content. This factor corresponds to Factor 2 in the white sample, while Factor 3 here corresponds to Factor 1 there.

Factor 2: Convergent Thinking, Semantic

Factor Loading	Task No.	Task Name
.667	2	Three Cube Pyramid (deleted in combined analysis)
.555	11	Stick Test (production)
.503	16	Food Naming
-.473	7	Geometric abstractions

Hyperplane: 1, 4, 6, 8, 10, 12, 13, 17, 24

This factor is difficult to name, especially with #7 negative while it is positively loaded at a high level in Factor 3, suggesting that Factor 2 is definitely not divergent thinking, although there is an emphasis upon visualization. In Task #11, the child visualizes and perhaps names the object he wishes to produce and tries to represent it with the sticks. It is to be conjectured that he recalls a visual image of the food as he names it. Task #2, the Three Cube Pyramid, lends itself easily to this naming interpretation at the age of five years.

Factor 3: Divergent Thinking, Semantic

Factor Loading	Task No.	Task Name
.698	15	Agent Action
.628	14	Action Agent
.574	5	Ambiguous Forms (elaboration)
.488	9	Round Things
.449	8	Word Meaning
.416	7	Geometric Abstractions
.396	6	Hidden Figures
.388	4	Ambiguous Forms (ideas)
.333	12	Stick Test (elaboration)

Hyperplane: 2, 3, 11, 18, 19, 20, 22, 26

This factor is very clearly semantic, except for Tasks #6 and #7. Hidden Figures has been factorially complex in other studies, but seldom with a semantic component. There is the possibility that instructions are so difficult as to induce a semantic component in test performance. Its loading in Factor 1 is almost equal to its loading in this factor, and both are relatively low in comparison to the larger number of high loadings of tasks which are clearly semantic.

Factor 4: Cognitive Reasoning

Factor Loading	Task No.	Task Name
.808	23	Block Sorting (color)
.730	22	Block Sorting (shape)
.664	24	Block Sorting (size)
.407	20	Dot Test (following directions)
.299	13	Copy Star, Diamond

Hyperplane: 3, 5, 10, 11, 12, 19, 25, 26

Although cognition as a process was not introduced at the construct level for the white group, Factor 3 for the white group seems to be identifiable with this factor for the black group. In Guilford's Structure of Intellect model, Cognition occupies a prominent role. In Merrifield's three process model, Cognition emerges as a composite of the basic process of Memory and Evaluation, while Convergent Production is a resultant of Evaluation and Productive Thinking. In this factor, which might be merely a Block Sorting specific, as it was initially labeled for the white group, the tasks seem to require more short term memory than do the tasks in Factor 1. However, any common factor labeled for this set of tasks seems tenuous. The presence of the Dot Test and the borderline inclusion of the Copy Star and Diamond, both of which obviously involve short term memory, tends to free the factor from the specific name originally given to the same factor for the white group.

Factor 5: Convergent Thinking, Figural Systems

Factor Loading	Task No.	Task Name
.714	3	Six Cube Pyramid
.467	1	Little Pink Tower
.366	25	Thumb and Finger
.363	21	Directions Test (boxes and cars)
.314	4	Ambiguous Forms (ideas)

Hyperplane: 2, 5, 9, 12, 13, 15, 17, 18, 19, 22, 23

Like Factor 1, with which it could perhaps be merged, this set of tasks requires goal directed thinking in spatial context, with emphasis on systems, as in the Six Cube Pyramid, with its high loading, and the Directions Test, with its requirement of connecting the relationship of the cars to the boxes.

Summary:

As in the white sample, the clearest separation is in terms of content (figural vs. semantic) with some confounding of convergent with figural and divergent with semantic. However, once these two major components of the battery are considered, recognizing the cognitive aspects of the Block Sorting (almost specific) figural, the convergent and divergent clusters of tasks so dissimilar produce a result on the whole consistent with the findings of the previous work. So we have for these two groups, the white and the black, the following factors:

White

Factor 1: Divergent Thinking, Semantic

Major loadings:
- Action Agent
- Ambiguous Forms (elaboration)
- Agent Action

Factor 2: Convergent Figural Thinking

Major loadings:
- Copy Star and Diamond
- Pie Completion
- Dot Test (following directions)

Factor 3: Block Sorting, Cognition Figural

Major loadings:
- The three Block Sorting tests

Factor 4: Convergent Thinking, Figural Systems

Major loadings:
- Three Cube Pyramid
- Six Cube Pyramid
- Little Pink Tower

Black

Factor 3: Divergent Thinking, Semantic

Major loadings:
- Agent Action
- Agent Action
- Ambiguous Forms (elaboration)

Factor 1: Convergent Figural Thinking

Major loadings:
- Pie Completion
- Dot Test (following directions)
- Copy Star and Diamond (with much smaller loading)

Factor 4: Cognition, Figural

Major loadings:
- The three Block Sorting tests

Factor 5: Convergent Thinking, Figural Systems

Major loadings:
- Six Cube Pyramid
- Little Pink Tower

<u>Factor 5</u>: Convergent Thinking, Semantic

Major loadings:
- Word Meaning
- Food Naming
- Directions (boxes and cars)

<u>Factor 2</u>: Convergent Thinking, Semantic

Major loadings:
- Three Cube Pyramid
- Stick Test (production)
- Food Naming

These last two factors seem to be less readily paired, although Food Naming has a high loading in each. The white Factor 5 seems to be much more semantic than black Factor 2.

Comparison with previous studies of white three, four and five-year-old children gives the following:

Three-Year-Olds	Four-Year-Olds	Five-Year-Olds
Factor A. Convergent Figural Thinking Systems	Factor 5. Convergent Figural Thinking Systems	Factor 1. Convergent Figural Systems
Factor B. Divergent Thinking, Semantic	Factor 1. DMU Ideational Fluency	Not present in longitudinal study of five-year-olds
Factor C. Dot Test Special	Not given to four-year-olds	Not given to three-year-olds
Factor D. General Reasoning	Factor 3. CMS Verbal Reasoning	Factor 4. CMS Verbal Reasoning
Factor E. Convergent Figural Thinking, Units	Factor 2. NFU Convergent Figural Units	Factor 3. NFU Figural Units
Factor F. Psychomotor	Not differentiated	Not differentiated
Factor G. DMI Divergent Thinking, Originality	Factor 4. DMI Originality	Factor 2. DMI Originality

Section 3

White and black samples compared:

In Figure 1, the plots of the eigenvalues vs. inrotated factor position are shown. The black sample, consistent with its greater sum h^2 (communalities) has larger eigenvalues and the first discontinuity of the curving connecting these comes between Factors 5 and 6. This is yet another reason for treating five factors in that sample, although the rotated positions were not easily interpretable. The white sample shows no discontinuity--just a gradual fading away. However, the almost horizontal slopes of the h^2 value for Factors 4, 5 and 6 suggest that four factors, perhaps only three, should be considered for rotation. The third curve, showing the likelihood of at most three factors in the combined sample will be discussed more later, in Section 4.

In Table 3.0, the results of comparing performance of black and white children on the 26 tasks are shown. The interpretation of these values is as follows:

1. If percent whit is greater than percent black, more white children performed better (above the point nearest the combined median). If the reverse, black children performed better.

2. Proportion of variance indicates that proportion of variation in task performances which could be predicted from knowledge of race alone.

The first three tasks were time scores. The apparent anomaly of Task #2 begs explanation. In 14 out of the 18 tasks, the white children performed better at a p .01 level of significance (statistical). However, the Phi-squared values are not suggestive in any way that race is a good predictor of performance.

Tasks #9, #12 and #16 are all verbally facilitated, might represent the greatest divergence and might be considered as environmentally conditioned.

In summary, while statistically significant differences occur in level of performance on these tasks, the utility of race as a predictor of performances is very low, probably no more than that of sex and less than that of age. In every task, the range of performances for the two groups was equal or nearly so. The large sample size makes this statistical treatment quite sensitive to small amounts of skew, but also contributes to a more sober appraisal of utility.

Similar comparison will be made of factor scores derived from the combined sample in the following section.

FIGURE 1

Eigenvalues vs. Unrotated Factor Positions

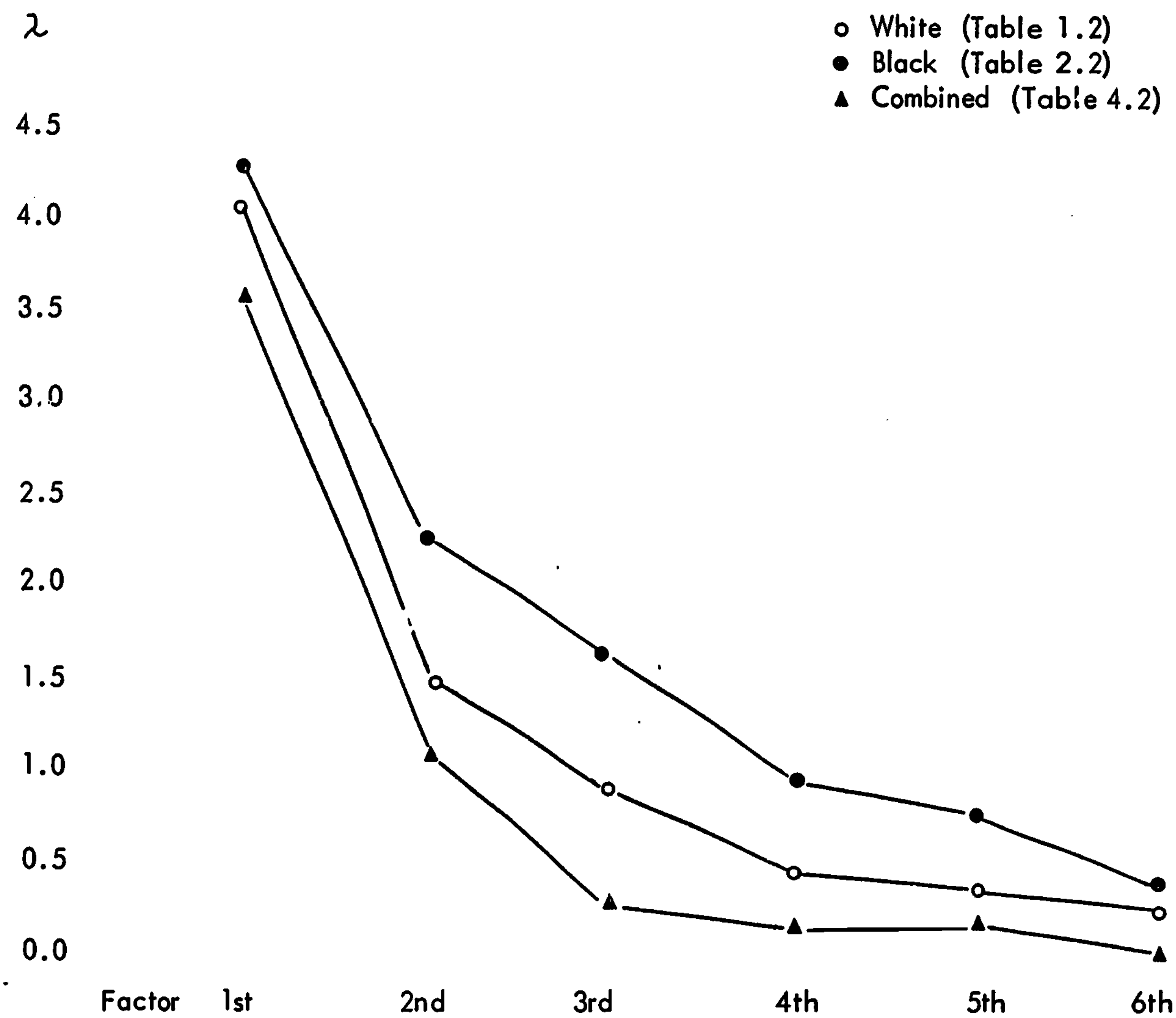


TABLE 3.0

Significant Differences in Percent Above

Point of Dichotomy[1] for White and Black Children

Task (Initial)	Percent[2] White	Percent[2] Black	Prop. of Variance Phi-Squared[3]
1[a]	47	54	.01
2[a]	67	22	.19
3[a]	45	63	.03
6	69	39	.08
7	71	50	.04
8	69	57	.01
9	59	16	.17
11	63	32	.08
12	70	25	.18
13	73	51	.05
14	59	35	.05
15	56	43	.02
16	68	26	.14
17	41	19	.05
19	54	42	.01
20	29	38	.01
24	63	52	.01
26	52	63	.01

[1] Point of dichotomy selected as near the median of combined groups as data allowed.

[2] Number in ethnic group above point of dichotomy, divided by total number in ethnic group. Nw = 400, Nb = 209.

[3] $\phi^2 = x^2/N$ ϕ^2 significant at $p < .05$ when $\phi^2 > .007$, $x^2 > 3.84$.

[a] Percents reflect those performing more rapidly.

Section 4

After inspection of the results of the analyses of white and black samples, the investigator decided to combine some variables and to delete others to form a more compact, yet hopefully differentiable battery for the analysis of the pooled samples. Based on the consistencies previously discussed, two clear factors could be expected, although more would be considered.

In Table 4.0, the names, means and standard deviations of the combined variables are shown. Black children's performances were re-coded to the white children's intervals, because of the differences shown in Table 3.0 and, more importantly, because factor scores were to be derived for the combined sample for comparison with the questionnaire data. This decision is reflected in the slightly lower means for some variables. The Tasks #15, #16, #17 and #18 are composites; thus, their means are not near the middle code value of 3.

Using the same stopping rate as previously, two factors exhaust the sum $h^2 = 4.377$ based on initial estimates of communality. This result is consistent with the plot for combined sample shown in Figure 1. However, because the program used requires the specification of number of factors in order to compute factor scores (a matter of storage capability not mathematics), five factors were rotated to the varimax criterion, as displayed in Table 4.3. It may be of interest to inspect Figure 2, a plot of the first two principal factors from Table 4.2, unrotated.

Two factors, oblique at about 70°, show clear hyperplanes and, except for Task #16, Hidden Figures, univocal loadings. These groupings correspond to rotated Factors 1 and 2 in the main; rotated Factors 3 and 5 have been tossed out of the large convergent figural factor in the lower right sector of Figure 2.

From Table 4.3, Factor 1 is the, by now, familiar Divergent Thinking, Semantic, and Factor 2 is Convergent Figural. Factor 3 is a small hint in the way of a cognitive reasoning factor, not unlike some IQ measures. From that point of view, it is indeed interesting to note how small its differentiation is relative to the productive thinking factors. Of course, the study did not seek to measure IQ in the usual sense so that "factor" (if it exists at this level at all) was under represented in the battery. Factor 4 is not a significant contributor. Factor 5 carries a sense of psychomotor involvement, compounded with some differentiation attributable to systems as a way of organizing information.

In summary, while two clear factors emerged, factor scores were computed on four factors, as follows:

TABLE 4.0

Test Battery, All Children

N = 609

Test No.	Name	Means	S.D.'s
1	Little Pink Tower	3.292	1.163
2	Six Cube Pyramid	2.966	1.154
3	Word Meaning	2.916	.974
4	Round Things	2.695	.954
5	Stick Test (matching)	3.626	.853
6	Copy Star, Diamond	1.054	.869
7	Agent Action	2.801	.948
8	Food Naming	2.722	.978
9	Drawing Completion	3.212	.732
10	Pie Completion	2.793	.966
11	Dot Test (originality)	2.987	1.087
12	Dot Test (following directions)	3.110	.862
13	Directions Test	3.128	1.332
14	Thumb and Finger	.824	.445
15	Ambiguous Forms	6.118	1.634
16	Hidden Figures	6.901	2.412
17	Stick Test (production)	6.184	1.421
18	Block Sorting	2.332	.910

TABLE 4.1

Correlation Matrix, Combined Sample

609 children
18 variables

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	.102																	
2	.270	.242																
3	.027	.131	.303															
4	.015	.195	.408	.433														
5	.061	.247	.138	.164	.151													
6	.118	.263	.221	.353	.289	.321												
7	-.035	.097	.443	.464	.093	.235	.426											
8	.035	.010	.281	.300	.102	.219	.362	.211										
9	-.015	.088	.233	.328	.056	.207	.243	.218	.181									
10	.099	.288	.176	.336	.233	.415	.152	.171	.204	.283								
11	.058	.133	.116	.175	.094	.175	.058	-.005	.047	.140	.086							
12	.075	.247	.180	.235	.159	.310	.160	.095	.208	.270	.196	.214						
13	.175	.317	.289	.314	.267	.310	.163	.156	.215	.303	.125	.273	.316					
14	.100	.161	.095	.059	.095	.144	.077	-.029	.089	.114	.084	.141	.113	.102				
15	-.012	.163	.362	.413	.088	.197	.479	.174	.163	.121	.105	.195	.150	.155	342			
16	.063	.196	.250	.414	.142	.343	.350	.208	.286	.301	.120	.280	.306	.142	.311	.301		
17	-.048	.010	.197	.305	-.011	.149	.362	.224	.127	.092	.113	.033	.018	.002	.330	.159	.213	
18	.076	.157	.076	.077	.097	.162	.075	.074	.146	.061	.074	.209	.298	.201	.048	.159	.060	.155
h^2	.140	.331	.353	.508	.186	.393	.524	.275	.241	.364	.115	.273	.396	.150	.432	.348	.252	.222

TABLE 4.2

Factor Matrix Before Rotation

Combined Sample

Variable	Factor 1	2	3	4	5
1	.128	-.285	.075	.060	-.183
2	.385	-.368	.112	.144	-.118
3	.533	.202	.042	-.036	-.159
4	.677	.189	-.093	.058	.031
5	.316	-.247	-.086	.087	-.103
6	.565	-.201	-.145	.081	.076
7	.584	.416	.069	-.004	-.080
8	.393	.226	-.197	-.121	-.128
9	.414	.059	-.085	-.219	.105
10	.489	-.234	-.224	.120	.074
11	.240	-.112	.079	.140	.138
12	.441	-.223	.057	-.038	.156
13	.515	-.301	-.011	-.148	-.134
14	.219	-.175	.258	-.037	.061
15	.517	.296	.244	.133	.002
16	.575	-.006	-.012	.061	.114
17	.332	.357	.055	.090	.057
18	.261	-.217	.179	-.272	.029
λ	3.573	1.122	.329	.268	.211

TABLE 4.3

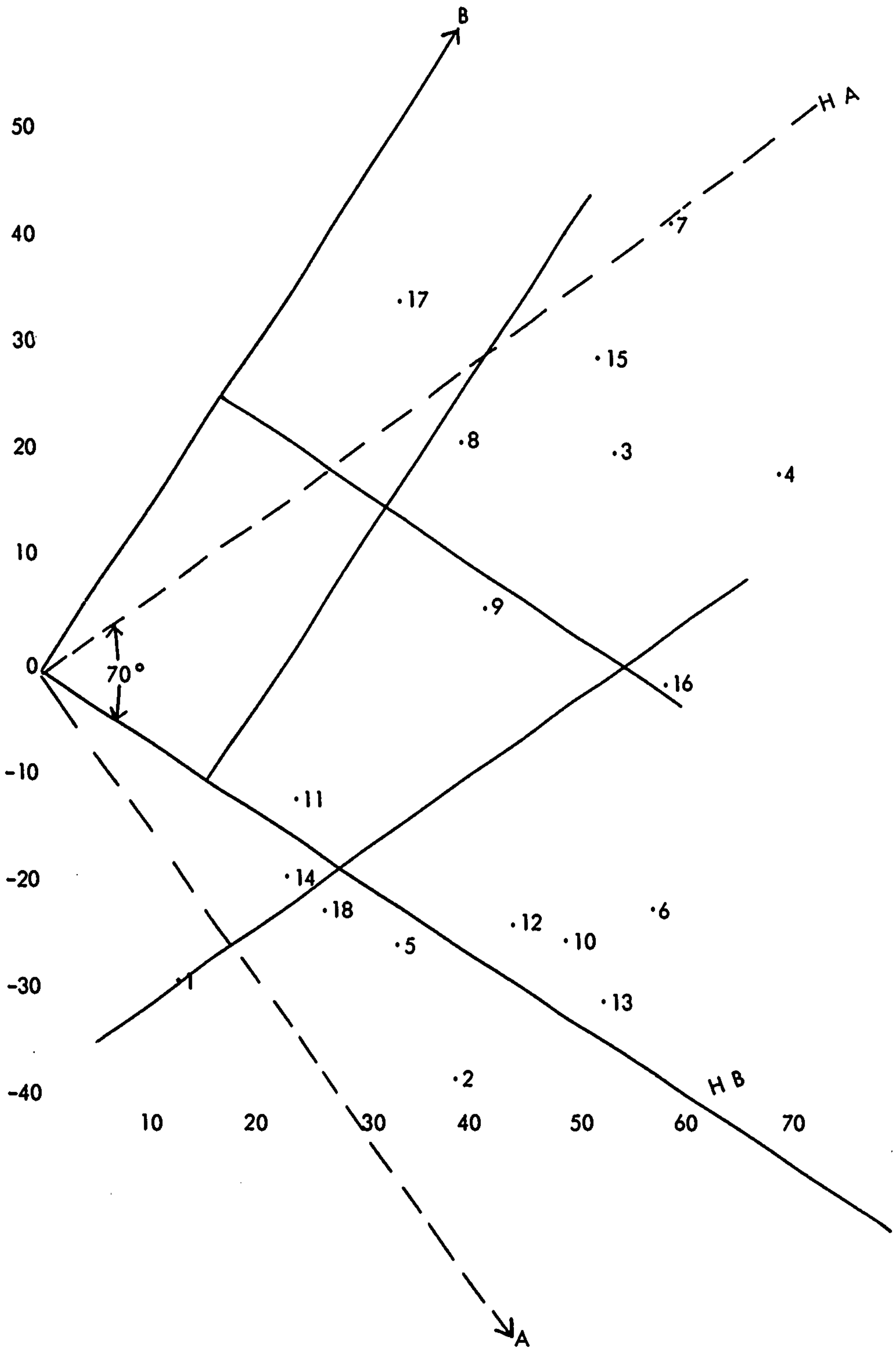
Rotated Factor Matrix

Combined Sample

Variable	Factor 1	2	3	4	5
1	-.057	.047	.085	-.030	.356
2	.062	.229	.162	-.171	.468
3	.541	.129	.128	.051	.157
4	.584	.388	.065	-.040	.085
5	.065	.276	.057	-.007	.320
6	.227	.510	.136	-.081	.237
7	.711	.106	.083	-.005	.011
8	.418	.199	.035	.244	.017
9	.284	.284	.261	.093	-.054
10	.144	.532	.056	-.053	.233
11	.083	.192	.073	-.238	.096
12	.130	.342	.299	-.162	.153
13	.169	.319	.341	.079	.378
14	.053	.038	.284	-.204	.154
15	.599	.047	.093	-.240	.068
16	.369	.368	.253	-.074	.084
17	.474	.063	-.308	-.106	-.104
18	.036	.087	.442	-.010	.132

FIGURE 2

Plot of First Two Principal Factors from Table 4.2



Factor 1: Divergent Thinking, Semantic

Factor Loading	Task No.	Task Name
.711	7	Agent Action
.600	15	Ambiguous Forms
.584	4	Round Things
.541	3	Word Meaning
.474	17	Stick Test (production)
.418	8	Food Naming
.369	16	Hidden Figures

Hyperplane: 1, 2, 5, 11, 14, 18

This factor is consistent with Factor 1 of the white group and with Factor 3 of the black group. With some of the tests originally separate now combined (such as Stick Test, production, and Stick Test, elaboration) into one test score. Even the questionable test, Hidden Figures, appears in all three factors.

Factor 2: Convergent Thinking, Figural

Factor Loading	Task No.	Task Name
.532	10	Pie Completion
.510	6	Copy Star, Diamond
.388	4	Round Things
.368	16	Hidden Figures
.342	12	Dot Test (following directions)
.319	13	Directions Test

Hyperplane: 1, 15, 17, 18

It is to be noted that Round Things appears in both factors as well as Hidden Figures; each of these is apparently mixed in meaning, each involving both divergent thinking and visualization. This composite meaning also holds for the factor matrices for both the white and black studies, particularly for Hidden Figures.

Factor 3: Cognitive Reasoning

Factor Loading	Task No.	Task Name
.442	18	Block sorting
.341	13	Directions Test
.299	12	Dot Test (following directions)

Hyperplane: 1, 4, 5, 7, 8, 10, 11, 15, 17

These rather small loadings give some indication of the meaning values of three of the tasks although the Dot Test loading is too low for much significance. When the three Block Sorting tasks are combined, they still fall into the cognitive reasoning area with some help in maintaining consistency with the earlier factor analyses.

Factor 4: This factor had no loading over .244.

Factor 5: Convergent Thinking, Figural Systems (NFS)

Factor Loading	Task No.	Task Name
.468	2	Six Cube Pyramid
.378	13	Directions Test
.356	1	Little Pink Tower
.320	5	Stick Test (matching)

Hyperplane: 4, 7, 8, 9, 11, 15, 16

This factor is similar to Factor 4 for the white group and Factor 5 for the black group. The content of each factor is consistent in spite of the relatively low eigenvalue for this combined factor.

Section 5

In addition to the white and black samples, the combination of white and black data for the aptitudes, as shown in Section 4, were used in the evaluation of the questionnaire data.

The choice of method of comparison required considerable analysis. The utility of such techniques as chi-squared and analysis of variance is too well established to require justification here. However, when one is dealing with a number of predictors, most of which are not manipulable; i. e., not under strict experimental control, the cross-categorization techniques are severely limited by violations of the assumptions made in their derivation. Where one might like to speak of the interactive effect of five or six variables on another, the cross-classifications which occur in nature are typically quite different from those required by the mathematics of design; e. g., that cell frequencies be proportional to all frequencies in the margins, or category totals. Another technique is needed. Further, one often wishes to consider the effect of a variable of major interest first, and then ask whether information from another source is useful in increasing the predictability of the dependent variable. This sequential building up of information is not possible through the usual chi-squared or analysis of variance technique. Fortunately, an older technique, that of multiple-regression, can be adapted to provide sequential increments of information in situations where the points of division between categories of a variable may be naturalistic, even though the frequencies in the cross-classifications may not fit the proportionality criteria. The full name of this old-new technique is stepwise-multiple-regression.

In this stepwise-multiple-regression technique, one begins by designating a dependent variable. In what follows herein, dependent variables are factor scores derived for the children from analysis of their performances on selected tests previously discussed. The essence of stepwise-MR is that all the information is used from the first predictor selected, then the second predictor is selected in such a way that its inclusion adds more to the multiple-regression value than would any other available predictor, then the third adds more than any other remaining, and so on.

At each stage, partial correlations of all unused predictors with the criterion (dependent variable) are computed, and the predictor with the largest partial is the next to be incorporated in the prediction equation for the ever increasing R^2. When the problem is solved without any specification on the predictor variables, the sequence is established empirically "by the computer" and the result can be interpreted with regard to comparisons of the value of the multiple-regression reached and the cost of the predictors included.

In some situations, the sequence of the predictors may be of interest; in the data to follow, it will be of interest to observe that different sequences of family life variables predict different factors, a fact which may be interpreted with regard to the relative importance of different aspects of family life to the emission of certain kinds of performance. (Here, as usually, we avoid the tempting causal inference.) The process of adding variables, each bringing its own unique contribution to the prediction of the criterion--unique in that all it shares with previously used predictors has already been accounted for--terminates in the computer when preset limits are reached, or outside when the investigator believes that the criteria of confidence and credibility are met.

The sequential-multiple-regression technique is also adaptable to situations in which the effects of specific variables are to be investigated as hypotheses, or imposed as controls. This adaptation is accomplished by setting priorities for the inclusion of specified independent variables (controls or predictors), which are then used regardless of the value of their correlation with the dependent (criterion) variable. When this version is used, it often happens that the increment in R^2 is relatively small for some of the priority variables. This outcome is to be interpreted only that a source of variation that concerned the investigator is relatively ineffective, and he should be reassured by that. If a control variable does have a large effect, the technique accounts for it, and the subsequent contributions are conditioned on its having been accounted for.

If the inclusion of an hypothesized predictor yields a statistically significant increment, the hypothesis may be said to be confirmed; if the increment is not significant, then not. In the ensuing discussion, increments are noted if they meet both the criterion of statistical significance and the rather low utility of contributing at least 1% of predicted criterion variance, in addition to what has previously been predicted. Because the sample sizes are large, statistically significant increments may be substantially less than 1%, but their interpretation is considered nonmeaningful.

The data presented are derived with the allocation of priorities to the following sources of variation, in order: race, age, sex, education of mother, marital status. After the analysis, it appeared that area was a major contributor, and could have been included in the priority set; it is empirically the sixth predictor in all but one of the nine sequences investigated.

All of the questionnaire items are shown on the following page.

Before looking at the multiple-regression results, it may be of interest to inspect the zero-order (pair-wise) intercorrelations of the priority predictors and the empirically salient predictors with the factor scores in the three groups. The priority predictors were named above. It will be recalled that three groups are being studied: a combined sample, a white sample, and a black sample. From the previous discussion of performance, two strong factors emerged: a semantic, divergent thinking factor and a figural context, convergent thinking factor. In these results, the latter is further divided into figural, productive thinking, and figural, cognitive (evaluative) thinking. In brief, review:

Factor A. Semantic, divergent
Leading tests and loadings are:

.71	7	Agent Action
.60	15	Ambiguous Forms
.58	4	Round Things
.54	3	Word Meaning

Predictors: Questionnaire Items

46. Race (white = 0; black = 1). Priority 1.
1. Age (in months 00 - 11). Priority 2.
3. Sex (boy = 1; girl = 2). Priority 3.
5. Education of mother (ninth grade = 1; HS = 2; college = 3). Priority 4.
2. Marital status (married = 1; single = 2; divorced or sepcrated = 3). Priority 5.

4. Area
6. Education of father
7. Occupation of mother
8. Occupation of father
9. Number of children in the home
10. Time father spends with child
11. Have TV
12. Have radio
13. Programs child watches
14. Goes to movies
15. Father reads to child
16. Mother reads to child
17. Father plays with child
18. Mother plays with child
19. Time with baby-sitters
20. Attended nursery school
21. Attends kindergarten
22. Plays with peers
23. Traits causing anxiety
24. Child with parents all his life
25. Who cared for child when a baby?
26. Did father help?
27. Did child cry a great deal?
28. Was he picked up when he cried?
29. Help in home
30. Problems about eating
31. Problems about toilet training
32. What enjoyed doing with child
33. Have meals with family
34. Talk at meal time
35. Do you stop him?
36. Is he talkative?
37. Does mother like to talk to him?
38. Does father like to talk to him?
39. Active as a toddler
40. Getting into things
41. Stay in play pen
42. Training not to touch objects
43. Family goes on outings
44. What kinds?
45. Is child adopted?

Factor B. Figural, productive of units
Leading tests and loadings are:

.53	10	Pie Completion
.51	6	Copy Star, Diamond
.39	4	Round Things
.37	16	Hidden Figures

Factors C and D in the five-factor solution are not included.

Factor E: Figural, cognition of systems, evaluative thinking
Leading tests and loadings are:

.47	2	Six Cube Pyramid
.38	13	Directions Test
.36	1	Little Pink Tower

Although the two-factor solution might have led to more reliable performance measures, it was hoped that separating the figural context into productive and cognitive-evaluative aspects might prove informative. This turns out to be the case with regard to some of the family life data.

Thus, the basic set of intercorrelations is the five predictors of major concern paired with the three factor scores, computed for combined white and black samples. These data, and more, appear in Table 5.1. A description of the coding of the family and personal descriptors is presented below. The coding, of course, affects the sign of the correlation, but not its magnitude. For example, for Race, white is coded 0 and black is coded 1; a positive correlation with a factor score would mean that black children had a higher mean than white children on that factor, while a negative value would mean the reversed, and so would need to be the interpretation.

<u>Coding Summary for Variables in Table A.1</u>

Race: white = 0; black = 1
Age: months after five years, 00-11
Sex: boys = 1; girls = 2
Education of mother: ninth grade = 1; high school = 2; college = 3
Marital status: married = 1; single = 2; divorced = 3; father dead = 4; mother dead = 5; status unknown = 6
Area: Phoenix and vicinity = 1; Detroit and vicinity = 2

Other codings will be described as the sources of variation are discussed, following the tabular presentations.

TABLE 5.1

Intercorrelations Among Selected Personal and

Family Data and Factor Scores, by Group

(decimal points omitted)

P. F. Data	No.	Combined*			White			Black		
P. F. Data	Factor	A	B	E	A	B	E	A	B	E
Race	46	-38	-29	12						
Age	1	-03	13	15	-01	12	13	02	20	18
Sex	3	-16	00	06	-15	00	03	-18	02	10
Education of mother	5	20	18	09	17	17	16	20	14	03
Marital status	2	-20	-21	01	-04	-06	-02	-17	-21	-03
Area	4	-26	-32	-35	-46	-42	-18	-12	-17	-60
Play	17, 18	37	16	-05	30	06	00	19a	11	-09
Occupation of father	8	34	26	-04	16	12	06	25	19	-02
Education of father	6	30	27	-01	14	20	15	18	10	-10
Number of children	9	-17	-10	06	-09	-09	-05	-14	-01	13
Anxieties	23	16	08	-08	23	01	-03	-06	-07	-13

Notes:

* Combined sample, N = 506, r.05 = .09
White sample, N = 316, r.05 = .11
Black sample, N = 190, r.05 = .14

a These values are for variable 17 in the black sample; in other samples, values for 17 and 18 were very close; in the black sample, those for 18 (mother plays with child) is a negligible source.

Although many of the correlations in Table 5.1 are statistically significant, the utility of such small values must be seriously questioned. The proportion of variance shared by two measures is the square of their coefficient of correlation, so that the rather impressive -.38 between race and Factor A shows that less than 15% of the variance in Factor A can be attributed to difference in race.

On the other hand, 15% is not really a small contribution, considering the general run of prediction studies. Comparing the relative magnitudes across factors, one notes that the relation with race is much less with Factor B, and reversed with E, so that, in the figural cognitive, black children outperform white children. With respect to age, Factor A seems unaffected, but the figural Factors B and E are positively related to age.

The general run of reports on creativity suggests that girls outperform boys in verbal tasks, particularly those involving fluency; not so here. Boys have higher means than girls in Factor A, while sex seems unrelated to B and E. At what age, and under what circumstances, the switch to the often reported result occurs, is an intriguing goal for further study.

Education of the mother, a consistent concern of this investigator, emerges once again as a contributor to all three factors, except for Factor E in black children. Marital status is related in predicted directions; it is of interest that it seems more related in the performance in black children than in white children.

Area deserves further consideration than it can be given at this writing. Apparently there is a general suppression of scores of children in Detroit relative to those in Phoenix in the white sample. This effect is more in the productive thinking scores, but in the black sample, the figural cognition seems markedly affected. Unfortunately, the performances on that factor (E) involve timed performances and it would be easy for an examiner to become impatient. More unfortunately, this source of variation was not detected in time to permit separate analyses for the two areas. However, in the subsequent multiple-regression data, the effects of differences between areas is accounted for early in the sequence so that the increments thereafter are still interpretable.

The empirical sources of variation in Table 5.1 were selected from the combined sample, Factor A (semantic, divergent). Whether the parents play with the child is clearly a source contributing to performance on Factor A, a reassuring outcome. Occupation of the father seems to have a more differentiating effect in blacks than in whites, and in the semantic rather than figural context. Interestingly, education of the father, though still effective, is less differentiating.

With regard to the number of children in the family, Factors A and E are related differently in blacks, but not significantly in either direction in whites. The caring

TABLE 5.2

Relations Among Factor Scores, by Group

(decimal points omitted)

Factor		Combined			White			Black		
		A	B	E	A	B	E	A	B	E
Sem. Div.	A	(61)	20	-02	(63)	14	-09	(49)	04	-07
Fig. Prod.	B		(58)	37		(62)	47		(59)	36
Fig. Cogn.	E			(53)			(46)			(76)

Note: The correlation between factors B and E, although they were rotated orthogonally, suggests that one factor may be represented by the two together. However, as noted earlier, the distinction leads to interesting outcomes.

The diagonal entry in ( ) is the highest value reached in the multiple-regression and represents a lower bound estimate of the reliability of the factor score.

parent, as reflected by number of traits reported to cause anxiety, contributes positively to the white child's performance on A, but negatively to the black child's performance on E, an intriguing contrast.

Section 6--Increasing Values of R^2

Discussion of Table 6.1

Once the effects of difference in race are accounted for, with respect to Factor A in the combined sample, age has little effect. Sex, boys doing better, contributes 2% of the variance in white children and 3% in black. Education of the mother, conditioned as it is to differences already accounted for by race, age and sex, contributes 3% and 4% respectively.

It is of interest that marital status contributes more to the prediction in the black sample than in the white, and in the direction suggesting that children with married parents perform at a higher level on Factor A.

First of the empirically salient predictors, Area contributes 21% of new prediction in the white sample, but less than 1% in the black sample. Why should semantic divergent thinking in Phoenix area white children be so much higher than for Detroit area white children? To be sure, this finding is reminiscent of earlier results with younger children in our previous studies, but the examiner suspected there was an ameliorated effect insofar as possible in these data. What is particularly interesting is that the difference in area seems not to matter with respect to black children. Might the areas differ only with respect to white subculture, not for blacks? If one hypothesizes that the effect of examiner attitude may be related, while different examiners white for white children and black for black in the Phoenix area, the same examiner tested both black and white children in the Detroit area.

Next in sequence, for white children, is a sizable 4% increment predicted by whether the mother plays with the child; higher performance occurs in children whose mothers play with them. This finding is not repeated in the black sample. The number of children in the home is negatively related to the total sample, but may be confounded with race; it does not seem to be effective in the separate samples.

Similarly, the occupation of the father shows up at this stage in the total sample, but later in the black sample and not at all in the white sample. Apparently the earlier predictors are sufficiently related to this datum in the white sample that its remaining partial correlation is too small to be considered.

White children whose parents report more traits causing them anxiety do better on Factor A, but that behavior is nonpredictive in the black sample. Going to the movies seems to have no effect on Factor A in white children, but a deleterious effect in black children. Similarly, but strangely, the black mother reading to her child seems to be negatively related to his performance on Factor A, but with only a 1% increment.

TABLE 6.1

Increasing Values of R^2 (Proportion of Variance), Factor A

(decimal points omitted)

P. F. Data	No.	Combined	White	Black
Race	46	15*		
Age	1	15a	00	00
Sex	3	17*	02*	03*
Education of mother	5	19	05	07
Marital status	2	20*	05a	09*
Area	4	27*	26*	b
Play, mother	18	30	30	
Number of children	9	31*		
Occupation of father	8	32c		
Number of anxieties	23		32c	
Child goes to movies	14			12*
Mother reads	16			13*
Occupation of father	8			15
Trained not to touch	42			16

Notes:

* This sign indicates that the contribution is inversely related to the coding of the personal family (P. F.) data item, as previously discussed. R^2, of course, is always positive.

a The increment is not statistically significant; this notation applies only to the variables given a specific priority.

b. A blank indicates that the P. F. data did not contribute to the prediction of that score; however, other variables may do so. The table is organized to show the combined sample compactly; then those variables effective in the white sample, and then those in the black sample. In the black sample, the P. F. item most effective after marital status was child goes to movies.

c The sequence list ends when R^2 cannot be increased by 1% or more by including any single remaining variable.

The black child whose father has a higher occupational level and who was trained not to touch objects with positive action (either punishment or verbal remonstrance or demonstration) does better on this ability of semantic, divergent thinking.

Comparing the two samples, the major difference is with respect to area; secondarily, one might suggest that the high performing white children are responding to play with parents and parental concern about their personality development, while the high performing black children are in a more structured, perhaps even striving, environment. What is important is that none of the aspects of personal or family life, except those specified in advance, was the same in the two prediction sequences. What this implies for the efficacy of uniform treatment; e. g., in fixed models of compensatory education, is not at all clear.

Discussion of Table 6.2

Factor B involves figural, productive thinking. Here the effects of age are apparent, in both white and black samples, more so in the latter. In contrast to Factor A, sex is not a differentiating attribute here. Apparently the widely believed difference in favor of boys; e. g., in geometry and mechanical drawing, develops later. As in Factor A, education of the mother is an important incrementing source of differences in children, and again marital status is so for blacks but not for whites.

Among the empirical salients, area once again dominates, being more effective for whites than for blacks; the same questions raised in connection with Factor A still nag. Since area differences did not occur with blacks in spite of the fact that it was believed the results of having black examiners would be productive of better responses. The white examiner of the Detroit blacks seemed to gain equally good results as the black examiners in the Phoenix area in the responses to Factor B.

In white children, the talkative child seems to do less well on Factor B, perhaps because he is investing his energies elsewhere, while black children proved to be less talkative. Parental concern seems to inhibit performance on B, while a larger number of children and more frequent family outings seem to enhance performance. Black children, on the other hand, have a larger percentage of working mothers who are unable to take their children on frequent outings. One gets the picture of a white child who is curious, probing, looking, manipulating visually, in his environment.

In marked contrast, black children seem to develop performance of this sort in quite a different setting, characterized, as for Factor A, by what is apparently a great deal more structure both physical and adult-oriented. Again, the difference in the content of the predictors of the same factor in this different ethnic group is quite remarkable.

TABLE 6.2

Increasing Values of R^2, Factor B

(decimal points omitted)

P. F. Data	No.	Combined	White	Black
Race	46	08*		
Age	1	10	02	04
Sex	3	10a	02a	04a
Education of mother	5	13	06	07
Marital status	2	15*	06a	11*
Area	4	25*	24*	14*
Child talkative	36	26*	26*	b
Number of children	9	27*	28	b
Anxiety causing traits	23	28*	27*	
Nursery school	20	29c		22
Family outings	43		30	
Stay in play pen	41			18*
Father helps care	26			20
TV watching	13			23*
Kindergarten	21			25
Trained not to touch	42			26
Occupation of father	8			27
Education of father	6			28*
Who cared for baby	25			29

Notes: See Table 6.1.

Discussion of Table 6.3

The five specified predictors lead to essentially identical levels of prediction of Factor E, figural cognition. It is noteworthy that race per se differentiates children with respect to this factor only to a very minor degree, in contrast to its effectiveness with the other two factors.

The effectiveness of area is extremely marked with respect to black children here. It would appear that the area differences for blacks are much larger than for whites, just the converse of the situation for Factor A. An explanation might lie in the differing "openness" of the black environments in both of the two locations.

Again, comparing the two columns for black and white children, one is struck by the differences in content of the predictors. Again, the environment of the white high performing child seems permissive, relatively unconstrained; in contrast, the high performing black child would seem to have a more highly structured home.

In reviewing the three factors and their predictors, one might wish to retain the following distinctions and similarities:

- Race is more effective for language based performance than for spatial relations.
- Age is more effective for spatial abilities than for language.
- Sex contributes little at this age level.
- Marital status contributes more in blacks than in whites.
- Area differences are marked for white children and suggest major environmental sources of behavior.
- The high performers of the white children seem in all the factors studied to have more permissive, more concerned homes, although the amount of parental monitoring seems positively related to semantic divergent ability but negatively related to figural thinking.
- Black high performing children seem to have highly structured homes with concerned striving adults for all factors.

TABLE 6.3

Increasing Values of R^2, Factor E

(decimal points omitted)

P. F. Data	No.	Combined	White	Black
Race	46	01		
Age	1	03	02	03
Sex	3	04	02a	04
Education of mother	5	05	06	04a
Marital status	2	05a	06a	04a
Area	4	19*	09*	42*
Traits causing anxiety	23	21*	13*	b
TV watching	13	22	11	
Father plays	17	23*c		47*
Did child cry as baby?	27		14	
Talkativeness	36		15*	
Occupation of father	8			44
Toilet training problems	31			46*
Kindergarten	21			48
Plays with peers	22			49

Notes: See Table 6.1.

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